State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF TROUT IN SECTIONS OF LITTLE LAST CHANCE CREEK PLUMAS COUNTY, 2003

by

Charles J. Brown
Central Valley Bay-Delta Branch

2004

STATE OF CALIFORNIA
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF TROUT IN SECTIONS OF LITTLE LAST CHANCE CREEK PLUMAS COUNTY, 2003

by

Charles J. Brown
Central Valley Bay-Delta Branch

STANDING STOCKS OF TROUT IN SECTIONS OF LITTLE LAST CHANCE CREEK, PLUMAS COUNTY, 2003

INTRODUCTION

The Department of Water Resources (DWR) initiated an instream flow program in 1976 to identify streams that would benefit from flow enhancement and to assess instream values. This information could be used to justify additional flow releases as a means of increasing trout populations. The Northern District of the DWR selected Little Last Chance Creek below Frenchman Reservoir (Figure 1) as one of the streams to study under this program.

Department of Fish and Game (DFG) biologists studied trout populations in Little Last Chance Creek in late summer or early fall of 1976, 1981, 1986, 1988, and 1991 through 1997. Brown trout (*Salmo trutta*) was the only game fish caught every year. Sacramento suckers (*Catostomus occidentalis*) were also caught (Brown 1976, Bumpass et al. 1989, Brown 1991, Brown 1992a, Brown 1992b, Brown 1993a, Brown 1994, Brown 1995, Brown 1996, Brown 1997). This report documents the results of sampling conducted in 2003.

The purpose of the long-term study is to collect baseline data that may be used to evaluate the effects of the operation of Frenchman Reservoir on populations of trout in Little Last Chance Creek through the periodic sampling of fish at established stations in that creek. This data may also be used to measure the recovery of trout in Little Last Chance Creek following the rotenone treatment that the DFG conducted in June, 1991 to kill northern pike (*Esox lucius*) in Frenchman Reservoir (Brown 1992b).

METHODS

Standing stocks of fishes were estimated at three stations in Little Last Chance Creek in Plumas County in September, 2003. Stations were intentionally selected to be near stations sampled in previous DFG studies and are described in Appendix 1. Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 43.6 to 48.2 m. The length and average width of each station was measured. Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines (Figure 2). Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates of trout were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weight of each trout was determined by displacement (Figure 3). Fork length (FL) of each trout was measured to the nearest millimeter. Scale samples were taken for trout as a means of estimating age.

The distribution of fish caught is listed according to location. Standing stocks of brown trout and rainbow trout (*Oncorhynchus mykiss*) were calculated by station.

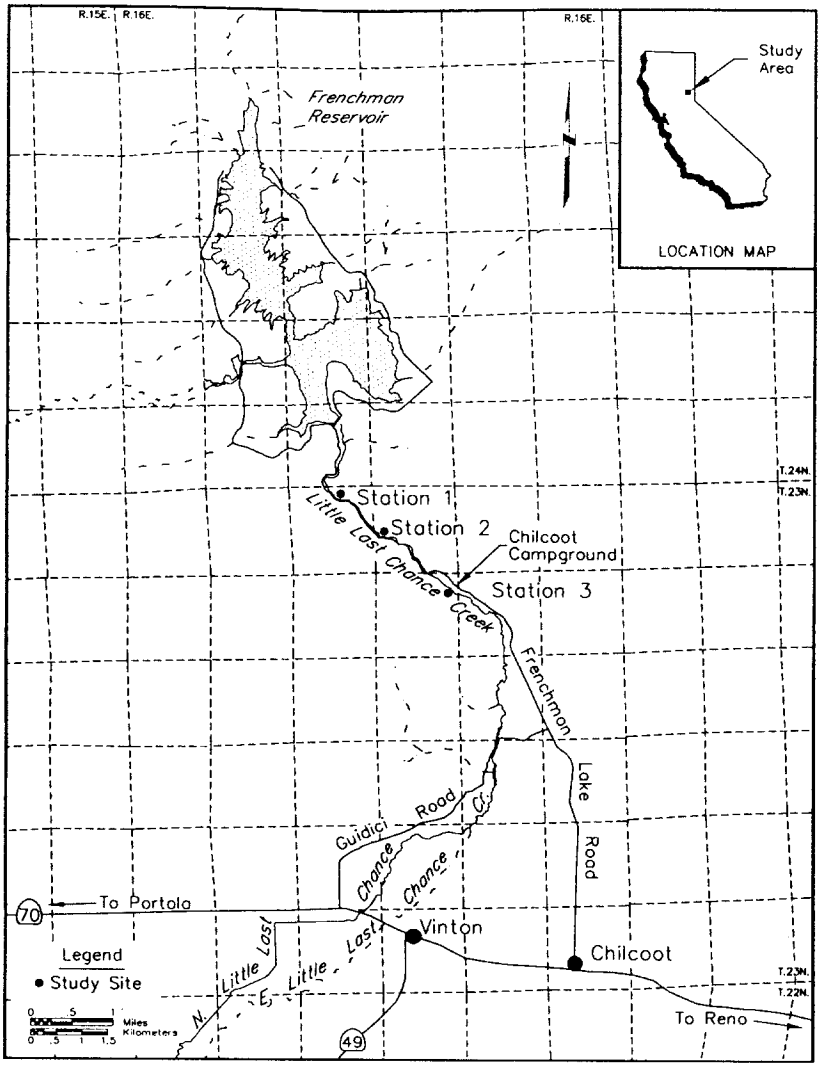

Figure 1. Map of sampling stations in Little Last Chance Creek, Plumas County, 2003.

Figure 2. Electrofishing

Figure 3. Weighing trout by displacement.

RESULTS

Brown trout were caught at each station. Rainbow trout were caught at station one (Table 1).

Table 1. Fishes caught in selected sections of Little Last Chance Creek, Plumas County, 2003.

	Station Number		
	1	2	3
Distance below Frenchman Reservoir (km)	1.6	3.2	4.4
Brown trout	X	X	X
Rainbow trout	X		

Brown trout ranged in size from 51 to 455 mm FL (Figure 4). Brown trout biomass averaged 38.8 g/m^2 at three stations. An estimated 220 brown trout large enough for anglers to catch and keep (≥127 mm FL) were present in the stations that we sampled (Table 2).

Table 2. Estimate of brown trout standing crop in Little Last Chance Creek, Plumas County, 2003.

Distance below Frenchman Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout (g/m^2)
1.6	63	48-90	43.9	47	32.8
3.2	67	62-46	44.0	62	40.7
4.4	126	111-143	28.5	111	25.1

Rainbow trout ranged in size from 156 to 267 mm FL (Figure 5). Rainbow trout biomass averaged 1.9 g/m^2 at one station. An estimated 4 rainbow trout large enough for anglers to catch and keep (≥127 mm FL) were present in the stations we sampled (Table 3).

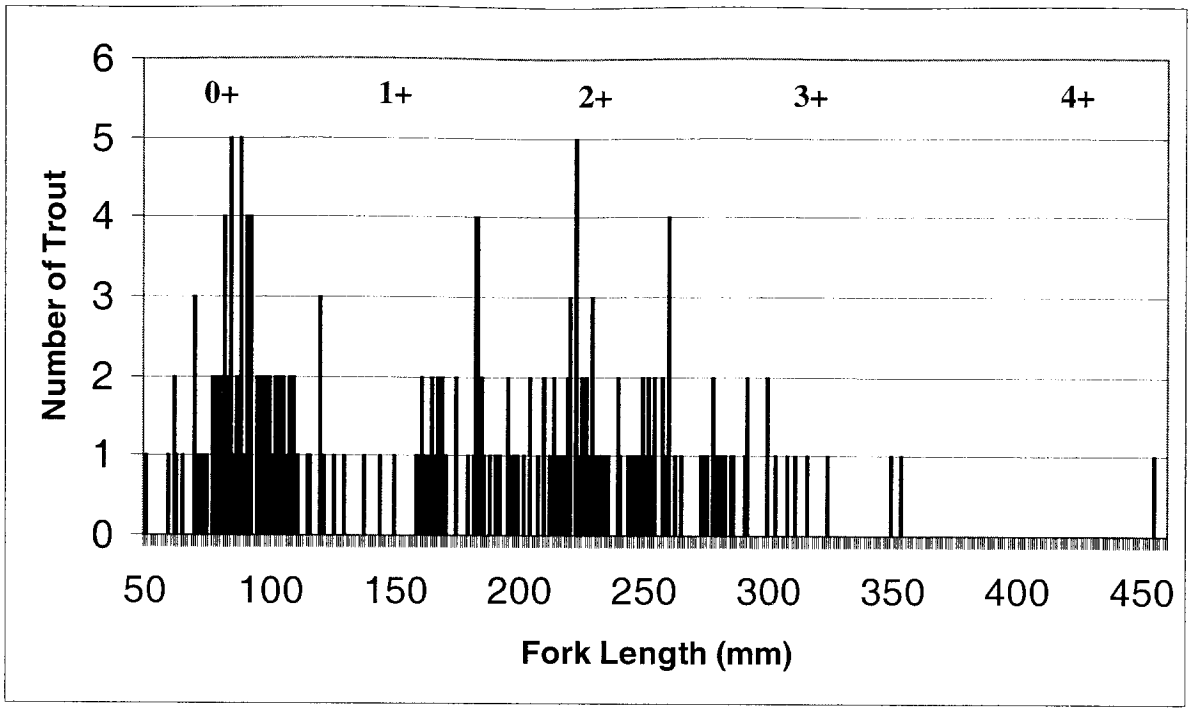

Figure 4. Length, observed frequency, and age of brown trout caught in Little Last Chance Creek, Plumas County, 2003.

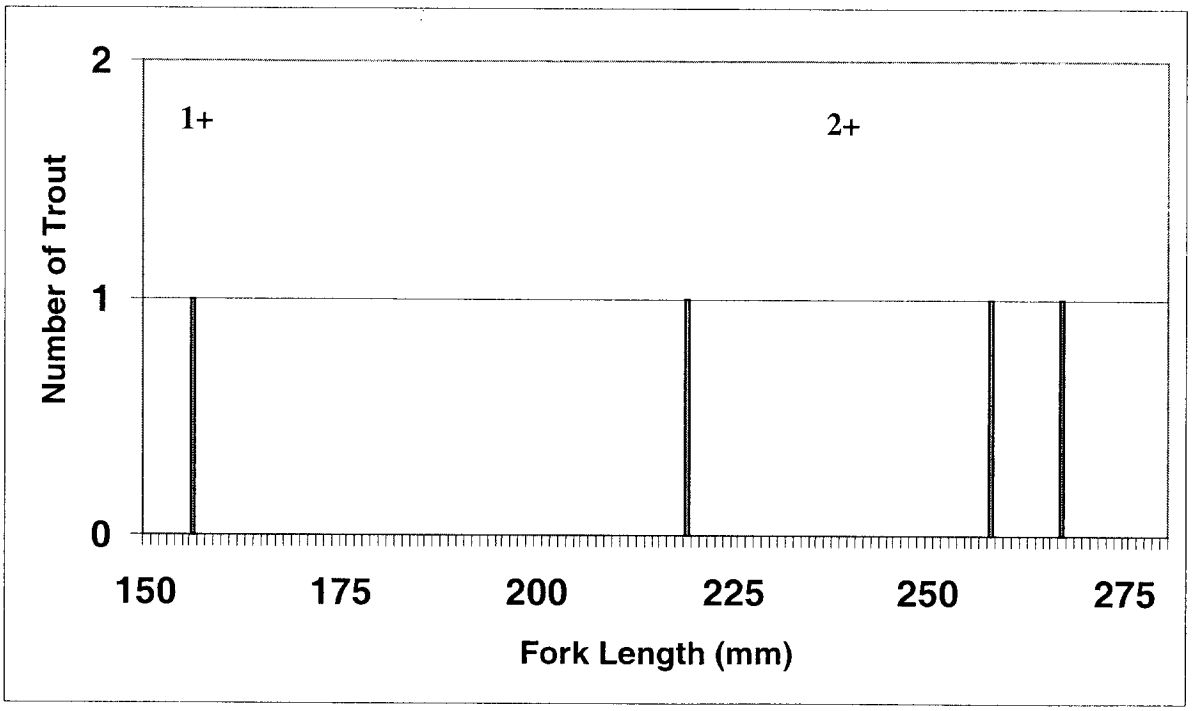

Figure 5. Length, observed frequency, and age of rainbow trout caught in Little Last Chance Creek, Plumas County, 2003.

Table 3. Estimate of rainbow trout standing crop in Little Last Chance Creek, Plumas County, 2003.

Distance below Frenchman Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout (g/m^2)
1.6	4	4-6	1.9	4	1.9
3.2	0	0	0	0	0
4.4	0	0	0	0	0

The relationship between fork length (FL) and weight (W) of brown trout is:

$Log_{10} W = -5.0 + 3.0 Log_{10} FL$

$r^2 = 0.99$

N = 221 (Figure 6 and Appendix 2)

The relationship between fork length (FL) and weight (W) of rainbow trout is:

$Log_{10} W = -4.8 + 2.9 Log_{10} FL$

$r^2 = 0.98$

N = 4 (Figure 7 and Appendix 3)

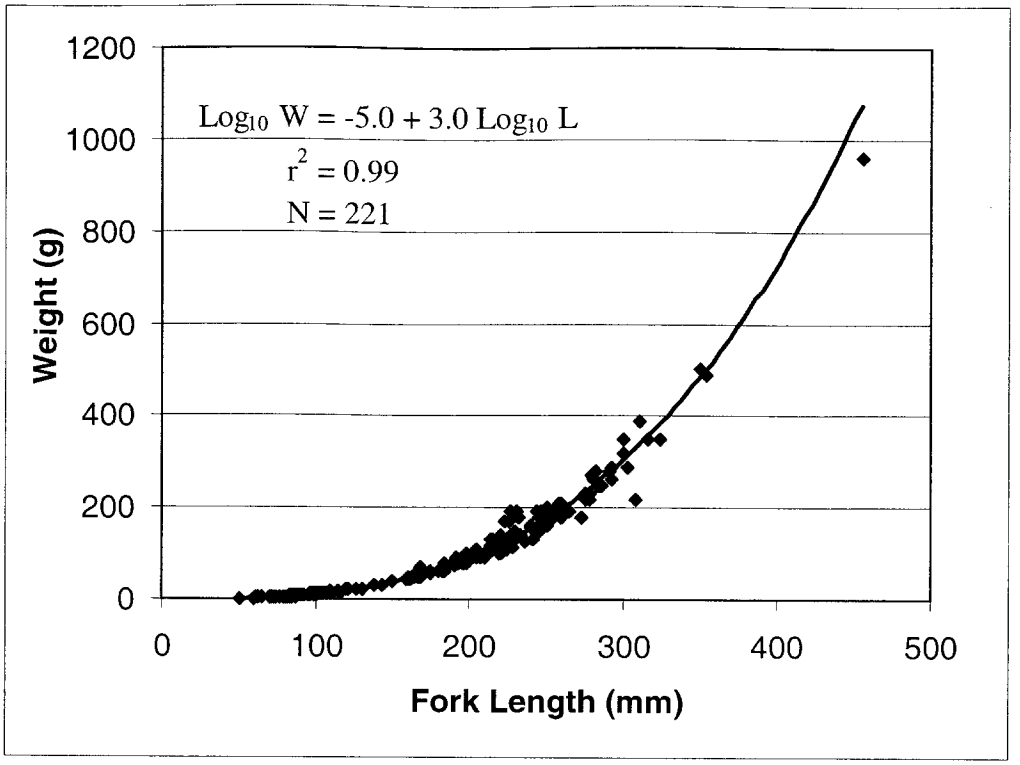

Figure 6. The relationship between length and weight of brown trout caught in sections of Little Last Chance Creek, Plumas County, 2003.

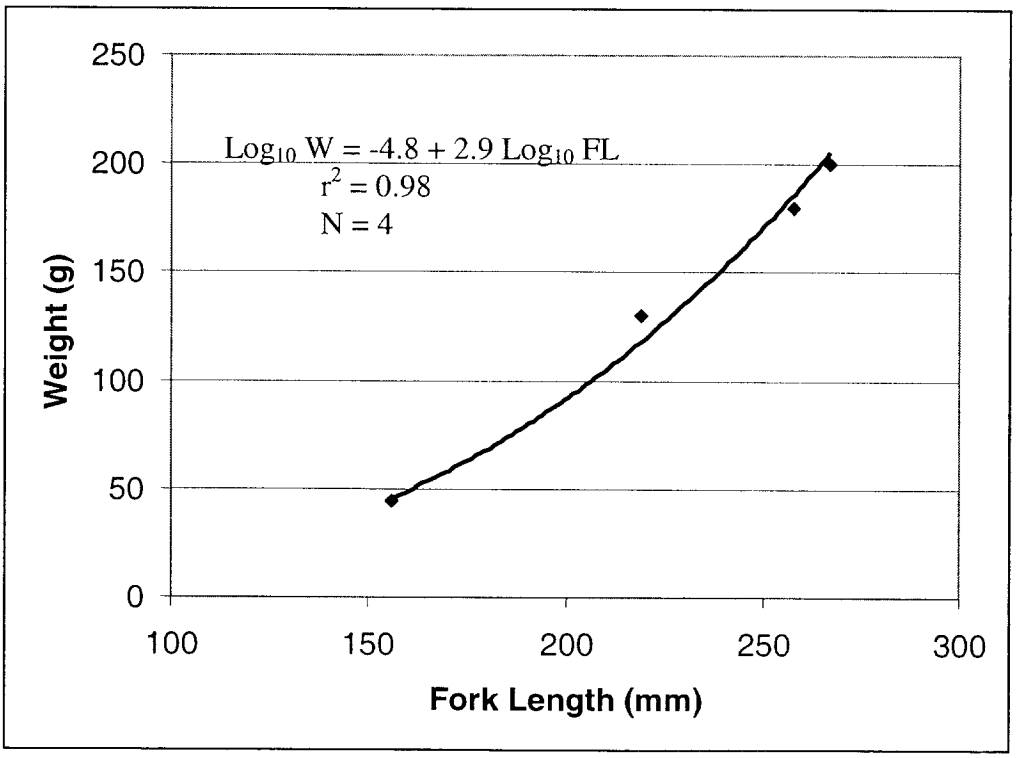

Figure 7. The relationship between length and weight of rainbow trout caught in sections of Little Last Chance Creek, Plumas County, 2003.

Age and Growth

Trout length and age are related. One way of measuring this is a correlation between trout lengths and the size of their scales. The formula FL = 7.8 + 0.2 S describes the relationship between the fork length and enlarged scale radius (S) of 117 brown trout caught in Little Last Chance Creek. The coefficient of correlation (r^2) is relatively high value of 0.82. The formula FL = -0.76 + 0.10 S describes that same relationship for 4 rainbow trout, while the value for r^2 is also relatively high at 0.78.

Population growth and mean individual growth was greater for rainbow trout (tables 4 and 5).

Table 4. Growth rates for brown trout caught in Little Last Chance Creek, 2003.

Age	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	102-208	0.7131	2.1377	114-208	0.6013	1.8040
2-3	208-299	0.6706	2.0118	201-299	0.3971	1.1914
3-4	293-397	0.2835	0.8505	315-397	0.2314	0.6942

Table 5. Growth rates for rainbow trout caught in Little Last Chance Creek, 2003.

Age	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	99-219	0.7940	2.382	112-219	0.6706	2.0117

Age 1+ and age 2+ brown trout averaged 167 mm and 239 mm FL, respectively. Age 3+ brown trout averaged 335 mm FL. One age 4+ brown trout measured 455 mm FL(Table 6). Age 1+ rainbow trout measured 156 mm and age 2+ rainbow trout averaged 248 mm FL (Table 7).

Table 6. Calculated average fork length of brown trout from Little Last Chance Creek, 2003.

Age	Number of Fish	Length at Capture	Length at Successive Annulus 1	2	3	4
1	48	167	102			
2	65	239	114	208		
3	3	335	115	201	299	
4	1	455	109	220	315	397
Number of Back Calculations			117	69	4	1
Weighted Means (mm)			109	208	303	397
Increments (mm)				99	95	94

Table 7. Calculated average fork length of rainbow trout from Little Last Chance Creek, 2003.

Age	Number of Fish	Length at Capture	Length at Successive Annulus 1	2
1	1	156	99	
2	3	248	112	219
Number of Back Calculations			43	3
Weighted Means (mm)			93	157
Increments (mm)				121

Coefficient of Condition

The average coefficient of condition for 221 brown trout was 1.1171 (Table 8) and 1.1604 for 4 rainbow trout (Table 9). Rainbow trout had slightly higher coefficients of condition than brown trout

Table 8. Condition of brown trout in Little Last Chance Creek, Plumas County, 2003.

Age	Number of Fish	Coefficient of Condition	95% Confidence Interval
0+	78	1.0996	0.8797-1.3195
1+	52	1.1152	0.9317-1.2988
2+	81	1.1373	0.8630-1.4116
3+	9	1.1106	0.8318-1.3895
4+	1	1.0191	
Combined	221	1.0964	0.8775-1.3567

Table 9. Condition of rainbow trout in Little Last Chance Creek, Plumas County, 2003.

Age	Number of Fish	Coefficient of Condition	95% Confidence Interval
1+	1	1.1363	
2+	3	1.1685	0.9227-1.4142
Combined	4	1.1524	0.9573-1.3635

DISCUSSION

Population trends of rainbow and brown trout have been increasing as a result of trout that the DFG planted (Table 10). Rainbow trout populations generally increased from 1996 through 2003 because Frenchman Reservoir periodically spills in the winter and spring. Rainbow trout populations averaged 32 during that period. Rainbow trout migrate downstream over the spillway into Little Last Chance Creek during spills. Few brown trout migrate during spills. Brown trout population estimates before treatment averaged 9 trout while after treatment averaged 46 trout. Biomass averaged 2.9 g/m^2 before treatment and 12.3 g/m^2 after treatment. Rainbow trout population estimates averaged 42 trout before treatment and 14 trout after. Biomass averaged 3.7 g/m^2 before treatment and 2.6 g/m^2 after (Table 11).

Relatively large numbers of brown trout were caught this year. There was good survival of each year class. Good survival is usually a result of favorable stream flows which result in high levels of survival (Brown 1993a). Few rainbow trout in the catch this year could be a result of predation of their young by the large population of brown trout.

Table 10. Records of trout planting in Little Last Chance Creek following initial treatment with rotenone in June 1991.

Year	Rainbow Trout		Brown Trout	
	Catchable	Fingerling	Catchable	Fingerling
1991	500	0	1,300	0
1992	1,000	0	0	0
1993	1,540	0	0	3,000
1994	0	0	0	5,240
1995	0	0	1,250	0
1996	0	0	0	3,000
1997	0	1,500	0	1,631

Some of the trout we caught in recent years were planted by the DFG. The DFG planted trout in the summer of 1991 and spring and summer of 1992 through 1997. The DFG planted catchable rainbow trout in 1991, 1992, and 1993. Catchable brown trout were planted in 1991 and 1995. Twenty brown trout broodstock were also planted in 1991. Fingerling brown trout were planted in 1993, 1994, 1996, and 1997. Fingerling rainbow trout were planted in 1997 (Table 10) (Ron DeCoto, Fishery Biologist, DFG, personal communication). No trout were planted this year.

Brown trout populations have largely recovered in Little Last Chance Creek from the treatment of rotenone that was used to kill northern pike in June, 1991. The DFG killed northern pike in this watershed to prevent them from migrating downstream into the Sacramento River and Sacramento-San Joaquin Delta. The DFG and others believe that pike could become established in the Sacramento River and become significant predators on juvenile salmonids (Brown 1992).

Forty two large brown trout (259-455 mm FL) were caught that were nearly ripe. They spawn in October or November. Spawning sized gravel is concentrated above station 1 which is where most trout spawn (Figure 1). Spawning was very successful last year. Many age 0+ brown trout were found in all stations.

Table 11. Average standing crop and biomass for brown and rainbow trout in Little Last Chance Creek, 1976-2003.

Year	Brown trout		Rainbow trout	
	Population estimate	Biomass (g/m^2)	Population estimate	Biomass (g/m^2)
1976	1	0.5	10	3.6
1981	6	2.7	17	4
1986	10	3.7	96	3.6
1988	20	4.7	43	3.7
Average	9	2.9	42	3.7
1991	1	0.2	0	0
1992	4	0.1	1	0.1
1993	11	1.1	0	0
1994	27	10.6	0	0
1995	34	26.2	1	0.1
1996	41	14.9	41	3.6
1997	27	12.3	63	12.7
2000	12	6.5	20	4.9
2003	221	38.8	4	1.9
Average	42	12.3	14	2.6

While our periodic sampling of trout in Little Last Chance Creek has allowed us to observe the prolonged effects of rotenone on trout populations and their recovery, the main purpose of our study has not changed. We plan to continue to evaluate the effects of the operation of Frenchman Reservoir on trout populations in Little Last Chance Creek.

LITERATURE CITED

Brown, C.J. 1976. Standing stocks of fishes in sections of Red Clover, Little Last Chance, Big Grizzly, Last Chance, and Squaw Queen Creeks, Plumas County, 1976. Calif. Dept. of Fish and Game. 17 p.

_____. 1991. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1988. Calif. Dept. of Fish and Game. 20 p.

_____. 1992a. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1991. Calif. Dept. of Fish and Game. 8 p.

_____. 1992b. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1981. Calif. Dept. of Fish and Game. 20 p.

_____. 1993a. A summary of studies of fish populations in Indian Creek, Plumas County, 1977-1990. Calif. Dept. of Fish and Game, 30 p.

_____. 1993b. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1992. Calif. Dept. of Fish and Game. 10 p.

_____. 1994. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1993. Calif. Dept. of Fish and Game. 10 p.

_____. 1995. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1994. Calif. Dept. of Fish and Game. 10 p.

_____. 1996. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1995. Calif. Dept. of Fish and Game. 10 p.

_____. 1997. Standing stocks of fishes in sections of Little Last Chance Creek, Plumas County, 1996. Calif. Dept. of Fish and Game. 15 p.

Bumpass, D.K., K.Smith, and C.J. Brown. 1989. Standing stocks of fishes in sections of Big Grizzly and Little Last Chance Creeks, Plumas County, 1986. Calif. Dept. of Fish and Game. 36 p.

DeLury, D.B. 1951. On the planning of experiments for the estimation of fish populations. J. Fish. Res. Bd. Canada. 8:281-307.

Leslie, P.H., and D.H.S. Davis. 1939. Attempt to determine the absolute number of rats in a given area. J. Animal Ecology. 8:94-113.

Seber, G.A.F., and E.D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3):631-643.

APPENDIX 1

PERMANENT FISH POPULATION STATIONS FOR
LITTLE LAST CHANCE CREEK, PLUMAS COUNTY
SEPTEMBER, 2003.

Station 1 - Located 1.6 km below Frenchman Dam just downstream from the first bridge at elevation of 1659 m MSL in NW 1/4 of NE 1/4, Section 4, T23N, R16E. This station begins in a riffle beneath the bridge of Frenchman Lake Road, then enters a pool with a deeply undercut room-sized boulder on the right bank. The remainder of the station is a short riffle and a shallow pool/run. About 55 percent of the station is pool and 45 percent riffle. Substrate is boulder, rubble, and sand. The station is 48.2 m long with a surface area of 195.2 m^2 at a flow of 0.4 cms.

Station 2 - Located 3.2 km below Frenchman Dam adjacent to the upper end of a large turnout at an elevation of 1610 m MSL in NW 1/4 of SW 1/4, Section 3, T23N, R16E. This station begins in a large plunge pool followed by two shallow pool/run areas and two short riffles. About 45 percent of the station is pool and 55 percent riffle. Substrate is boulder, rubble, and sand. The station is 43.6 m long with a surface area of 210.7 m^2 at a flow of 0.4 cms.

Station 3 - Located 4.4 km below Frenchman Dam adjacent to the cutoff road in the center of Chilcoot Campground at an elevation of 1561 m MSL in NE 1/4 of NE 1/4, Section 10, T23N, R16E. This station begins in a steep riffle followed by a long pool with undercut right bank, then a short riffle, a short pool, and finally, another steep riffle. The station is 40 percent pool and 60 percent riffle. Substrate is boulders, rubble, and sand. The station is 46.3 m long with a surface area of 247.8 m^2 at a flow of 0.4 cms.

Appendix 2

Length and Weight of Brown Trout Caught in Little Last Chance Creek, 2003

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
51	1	86	8	100	11	161	44
60	2	87	7	101	10	162	44
62	3	87	7	102	12	164	48
62	3	88	7	102	12	165	54
63	3	88	6	103	12	165	48
65	3	89	8	103	14	167	50
70	4	89	7	104	15	168	60
70	4	89	7	104	12	168	50
70	3	89	8	105	12	169	70
72	4	89	7	106	13	169	48
73	4	90	8	106	14	170	52
75	5	91	8	107	15	171	58
77	5	91	8	108	13	175	60
77	6	91	9	108	12	175	56
79	5	91	9	110	18	180	62
79	5	92	8	110	16	182	64
80	5	92	9	111	14	183	70
80	6	93	9	115	16	183	65
81	5	93	9	116	14	183	64
81	6	93	8	120	20	183	62
82	6	93	9	120	20	184	80
82	6	95	9	120	20	184	65
82	6	95	8	121	20	184	75
82	6	96	10	122	20	184	60
83	7	96	12	126	22	185	75
83	6	97	9	130	24	185	70
84	7	97	10	138	32	186	74
85	7	98	11	144	32	189	80
85	7	98	12	150	40	191	75
85	7	99	12	159	44	192	90
85	6	99	10	160	48	193	80
85	6	100	11	161	50	196	80

Appendix 2

Length and Weight of Brown Trout Caught in Little Last Chance Creek, 2003 (Continued)

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
196	90	227	190	260	200
197	80	227	140	260	180
198	80	228	115	260	190
199	100	230	150	263	200
200	90	230	130	265	190
202	90	230	140	273	180
205	110	231	190	275	220
205	90	232	180	276	230
208	90	233	140	278	220
210	100	234	140	278	230
210	90	235	130	280	270
213	100	236	125	281	260
214	130	240	160	282	280
214	120	240	155	283	250
215	130	241	130	285	250
217	115	244	190	286	250
218	115	245	150	291	280
219	100	246	180	292	290
220	125	247	190	292	260
220	100	248	160	300	350
221	120	250	200	300	320
221	140	250	160	303	290
221	140	251	175	308	220
223	170	252	190	311	390
223	120	252	170	316	350
223	110	253	180	324	350
223	120	255	450	350	500
223	125	255	180	354	490
224	120	258	200	455	960
225	110	258	210		
226	170	259	210		
226	120	260	210		

Appendix 3

Length and Weight of Rainbow Trout Caught in Little Last Chance Creek, 2003

Length (mm)	Weight (g)
156	44
219	130
258	180
267	200